

FINAL EXAM REVIEW PACKET 2014

Metric Conversions:

- A) 3.8 Km = 3800 m B) .0023 cL = .00023 dL C) 133.5 Hg = 13.35 Kg D) .0045 mL = .00000045 DaL

Convert into Scientific Notation:

- A) 12994 = 1.2994×10^4 B) .0004405 = 4.405×10^{-4} C) 3388.55 = 3.38855×10^3 D) .0033 = 3.3×10^{-3}

Convert to Regular Form:

- A) $6.033 \times 10^5 =$ 603300 B) $2.202 \times 10^2 =$ 220.2 C) $5.07 \times 10^{-3} =$.00507

Determine the correct number of significant digits:

- A) 356.56 = 5 B) 0.00201 = 3 C) 23000 = 2 D) 34.000 = 5

Record your answer in the correct number of significant digits:

- A) $3.5 + 2.003 =$ 5.5 B) $2.35 \times 1200 =$ 2800 C) $100.50 - 22.445 =$ 78.06 D) $80.626 / 21 =$ 3.8
5.503 2820 78.055 3.8393

Determine the molar mass for the following compounds

- A) MgCl₂ Mg = 1 × 24.31 = 24.31 Cl = 2 × 35.45 = 70.90 95.21 g/mol
 B) Mg(OH)₂ Mg = 1 × 24.31 = 24.31 O = 2 × 16.00 = 32.00 H = 2 × 1.01 = 2.02 58.33 g/mol
 C) Ca(NO₃)₂ Ca = 1 × 40.08 = 40.08 N = 2 × 14.01 = 28.02 O = 6 × 16.00 = 96.00 164.10 g/mol

Balance and classify the following Reactions:

- 2 C₃H₈ + 5 O₂ → 6 CO₂ + 8 H₂O Rxn type: combustion
2 HBr + 1 Ca(OH)₂ → 2 H₂O + 1 CaBr₂ Rxn type: DR A/B
3 Pb + 2 H₃PO₄ → 3 H₂ + 1 Pb₃(PO₄)₂ Rxn type: SR
2 AlBr₃ + 3 K₂SO₄ → 6 KBr + 1 Al₂(SO₄)₃ Rxn type: DR
2 Hg₂I₂ + 1 O₂ → 2 Hg₂O + 2 I₂ Rxn type: SR
2 N₂O₅ → 1 O₂ + 4 NO₂ Rxn type: D

Determine the percent composition by mass of sodium for the following two compounds.

- NaBr: Na = 1 × 22.99 = 22.99 Br = 1 × 79.90 = 79.90 102.89
 Na = $\frac{22.99}{102.89} = 22.34\%$
 Na₂S: Na = 2 × 22.99 = 45.98 S = 1 × 32.07 = 32.07 78.05
 Na = $\frac{45.98}{78.05} = 58.91\%$

Which compound has more Sodium by percent composition? Na₂S

Fill in the blanks with the correct terms:

Atomic # is equal the number of protons in an atom. It is found at the top corner of the periodic squares.

Atomic mass is the average mass of all the isotopes for a particular element. It's found at the bottom of the squares.

Mass # is the sum of the protons and neutrons of an atom. Most common isotope's can be found by rounding the average atomic mass.

Isotopes are forms of the same element, but different numbers of neutrons.

Ions are atoms that have gained or lost electrons.

Groups/Families Vertical columns on the periodic table. All elements in these columns have similar properties.

Periods Horizontal rows on the periodic table. All elements in these rows have same # of energy levels.

Oxidation # Term for the number of electrons gained lost or shared in order to get an octet.

Valence are the outermost electrons for an atom.

Ionic type of bonding where electrons are transferred. Formed between a metal and nonmetal.

Covalent type of bonding where electrons are shared. Formed between two nonmetals.

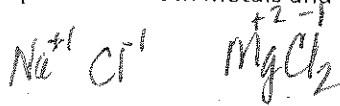
Percent Error The equation for this is ((Actual - Experimental) / (Actual)) x 100

Metals (+) are to the left of the staircase and have _____ oxidation numbers. This means they lose electrons.

Nonmetals (-) are to the right of the staircase and have _____ oxidation numbers. This means they gain electrons.

Metalloids are the elements that touch the staircase. They have properties of both metals and nonmetals.

Zero the sum of the oxidation numbers in an ionic bond.



Fill in the following table:

NAME	SYMBOL	ATOMIC #	MASS #	PROTONS	ELECTRONS	NEUTRONS	CHARGE
Nickel	Ni	28	59	28	28	31	0
Strontium ⁺²	Sr ⁺²	38	88	38	40 38	50	+2
Phosphorus ⁻³	33 15 P ⁻³	15	33	15	18	18	-3
Barium ⁺²	140 140 Ba ⁺² 56	56	140	56	54	84	+2

A compound, Ammonium Bromate has the following percent composition by mass. Determine the empirical formula for the compound.

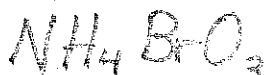
9.59 % Nitrogen 2.76 % Hydrogen 54.74 % Bromine 32.89 % Oxygen

$$N = \frac{9.59 \text{ g N} / 1 \text{ mol N}}{14.01 \text{ g N}} = \frac{.6845}{.6845} = 1$$

$$Br = \frac{54.74 \text{ g Br} / 1 \text{ mol Br}}{179.90 \text{ g Br}} = \frac{.3047}{.6845} = 1$$

$$H = \frac{2.76 \text{ g H} / 1 \text{ mol H}}{1.01 \text{ g H}} = \frac{2.733}{.6845} = 4$$

$$O = \frac{32.89 \text{ g O} / 1 \text{ mol O}}{16.00 \text{ g O}} = \frac{2.056}{.6845} = 3$$



A) You have determined that an empirical formula of CH_2O . What would be the molecular formula for glucose if its molecular mass is 180 grams/mol?

Handwritten work:
 $\frac{180 \text{ g/mol}}{30 \text{ g/mol}} = 6$
 $(\text{CH}_2\text{O})_6 = \text{C}_6\text{H}_{12}\text{O}_6$

B) An empirical formula for an Alkane would be C_2H_6 . What would be the molecular formula for Decane, with a molecular mass of 150.4 g/mol?

Handwritten work:
 $\frac{150.4 \text{ g/mol}}{30 \text{ g/mol}} = 5.013$
 $(\text{C}_2\text{H}_6)_5 = \text{C}_{10}\text{H}_{30}$

Molar Conversions:

Determine the number of moles in 2.5 grams of Oxygen

Handwritten work:
 $\frac{2.5 \text{ g O}_2}{32 \text{ g/mol O}_2} = 0.078 \text{ mol O}_2$

Determine the number of grams in 2.5 moles of Oxygen

Handwritten work:
 $2.5 \text{ mol O}_2 \times 32 \text{ g/mol O}_2 = 80 \text{ g O}_2$

Determine the number of particles in 2.5 moles of Oxygen

Handwritten work:
 $2.5 \text{ mol O}_2 \times 6.02 \times 10^{23} \text{ particles/mol} = 1.505 \times 10^{24} \text{ particles O}_2$

Determine the number of grams in 2.5×10^{23} formula units of NaCl

Handwritten work:
 $2.5 \times 10^{23} \text{ formula units NaCl} \times \frac{58.44 \text{ g NaCl}}{6.02 \times 10^{23} \text{ formula units NaCl}} = 24 \text{ g NaCl}$

Determine the moles of 200 grams of CaO

Handwritten work:
 $\frac{200 \text{ g CaO}}{56 \text{ g/mol CaO}} = 3.57 \text{ mol CaO}$

Determine the number of atoms in 36 grams of Carbon

Handwritten work:
 $\frac{36 \text{ g C}}{12 \text{ g/mol C}} \times 6.02 \times 10^{23} \text{ atoms/mol} = 1.8 \times 10^{24} \text{ atoms C}$

Stoichiometry

If you have 12 grams of Nitrogen, how many moles of Ammonia (NH_3) will you have? $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$

Handwritten work:
 $\frac{12 \text{ g N}_2}{28.02 \text{ g/mol N}_2} \times \frac{2 \text{ mol NH}_3}{1 \text{ mol N}_2} = 0.86 \text{ mol NH}_3$

If you have 3.5 moles of Hydrogen, how many grams of Ammonia (NH_3) will you produce?

Handwritten work:
 $3.5 \text{ mol H}_2 \times \frac{2 \text{ mol NH}_3}{3 \text{ mol H}_2} \times 17.04 \text{ g/mol NH}_3 = 40 \text{ g NH}_3$

4.5 moles of Calcium are used, how many moles of Lithium will be produced? $\text{Ca} + 2\text{LiF} \rightarrow \text{CaF}_2 + 2\text{Li}$

Handwritten work:
 $4.5 \text{ mol Ca} \times \frac{2 \text{ mol Li}}{1 \text{ mol Ca}} = 9.0 \text{ mol Li}$

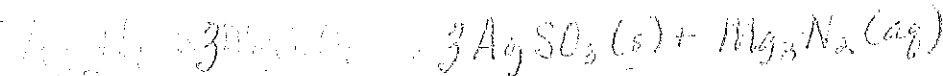
68.9g $CaCl_2$
45.8 grams of Lithium Fluoride will produce how many grams of Calcium Fluoride?

Translate, Predict the products, and Balance the equation:

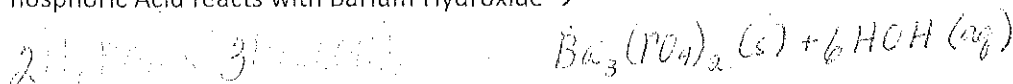
Potassium reacts with Aluminium Sulfate \rightarrow



Silver (II) Nitride combines with Magnesium Sulfite \rightarrow



Phosphoric Acid reacts with Barium Hydroxide \rightarrow



List the three subatomic particles, their location, their charge, and their relative size compared to each other:

proton: inside nucleus, +1 charge, largest size
neutron: inside nucleus, 0 charge, largest size
electron: outside nucleus, -1 charge, smallest size

If an experiment yields 3.56 grams of product, and the actual mass expected is 4.2 grams, what is your percent yield?

$$\frac{\text{ACTUAL}}{\text{THEORETICAL}} \times 100 = \frac{3.56g}{4.2g} \times 100 = 85\%$$

Name the group each element is a part of, write the number of valence electrons and determine the oxidation number.

- | | | | | |
|------------------------------------|-----------------------------------|-----------------------------|---------------------------|--------------------------------------|
| A) Nitrogen
nitrogen group
5 | B) Calcium
alkaline earth
2 | C) Chlorine
halogen
7 | D) Neon
noble gas
8 | E) Phosphorus
nitrogen group
5 |
|------------------------------------|-----------------------------------|-----------------------------|---------------------------|--------------------------------------|

Name the following compounds: Determine if they are Ionic and if a Trans. Metal is present, Covalent or an Acid.

- I A) $CaBr_2$ = calcium bromide
I D) AlF_3 = aluminum fluoride
I G) KNO_3 = potassium nitrate
A J) H_2SO_4 = sulfuric acid
C M) B_2Br_5 = diboron pentabromide
- B) NiP = ^{I trans}nickel (III) phosphide
E) H_2S = ^Ahydrosulfuric acid
H) CCl_4 = ^Ccarbon tetrachloride
K) ZnI_3 = ^{I trans}zinc (III) iodide
N) $Mn(ClO_4)_2$ = ^{I trans}manganese (II) perchlorate
- C) N_3O_7 = ^Ctrinitrogen heptoxide
F) $CuBr_2$ = ^{I trans}copper (II) bromide
I) S_2F_3 = ^Cdisulfur trifluoride
L) H_3PO_3 = ^Aphosphorous acid
O) HCl = ^Ahydrochloric acid

Write the correct formulas for the following compounds:

- A) Lithium Sulfite = Li_2SO_3
D) Phosphoric Acid = H_3PO_4
G) Copper (III) Iodide = CuI_3
J) Barium Oxide = BaO
- B) Iron (II) Phosphide = Fe_3P_2
E) Barium Nitride = Ba_3N_2
H) Aluminum Phosphate = $AlPO_4$
K) Gallium Hydroxide = $Ga(OH)_3$
- C) Tetrasulfur Pentafluoride = S_4F_5
F) Hydronitric Acid = H_3N
I) Calcium Oxide = CaO
L) Silicon Heptabromide = $SiBr_7$

M) Ammonium Phosphate = $(\text{NH}_4)_3\text{PO}_4$ N) Sulfurous Acid = H_2SO_3

HONORS:

Other Molar Conversions:

1) Determine the volume of 40 grams of CO_2 at standard temperature and pressure.

$$\frac{40 \text{ g } \text{CO}_2}{44.01 \text{ g } \text{CO}_2} \times \frac{1 \text{ mol } \text{CO}_2}{1 \text{ mol } \text{CO}_2} \times \frac{22.4 \text{ L } \text{CO}_2}{1 \text{ mol } \text{CO}_2} = 20 \text{ L } \text{CO}_2$$

2) What is the Molarity of 60 grams of NaCl dissolved in 250 mL of water?

$$\frac{60 \text{ g } \text{NaCl}}{58.44 \text{ g } \text{NaCl}} \times \frac{1 \text{ mol } \text{NaCl}}{1 \text{ mol } \text{NaCl}} = 1.026694045 \text{ mol} = 4 \text{ M}$$

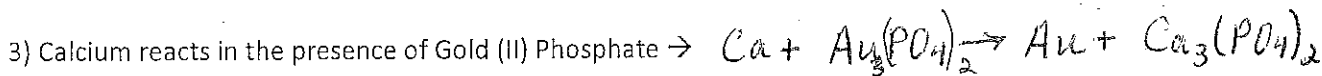
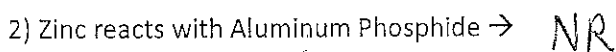
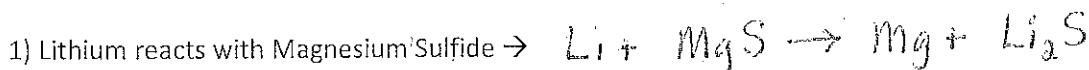
3) 80.0 grams of HCl is dissolved to create a 1.75 M solution of HCl. Determine the volume of the solution.

$$\frac{80.0 \text{ g } \text{HCl}}{36.46 \text{ g } \text{HCl}} \times \frac{1 \text{ mol } \text{HCl}}{1 \text{ mol } \text{HCl}} = 2.194185409 \text{ mol } \text{HCl} \quad 1.75 \text{ M} = \frac{2.194185409 \text{ mol}}{\text{L}} \quad \text{L} = 1.25 \text{ L}$$

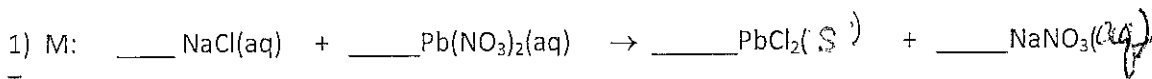
4) 12.5 Liters of Nitrogen gas at STP would be how many particles?

$$\frac{12.5 \text{ L } \text{N}_2}{22.4 \text{ L } \text{N}_2} \times \frac{1 \text{ mol } \text{N}_2}{1 \text{ mol } \text{N}_2} \times 6.022 \times 10^{23} \text{ mol } \text{N}_2 = 3.36 \times 10^{23} \text{ mol } \text{N}_2$$

Use the Activity series to determine if the reaction will take place. If so, predict products and write reaction:



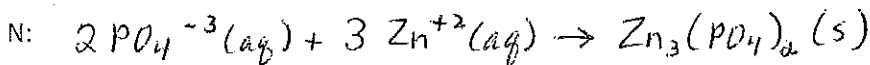
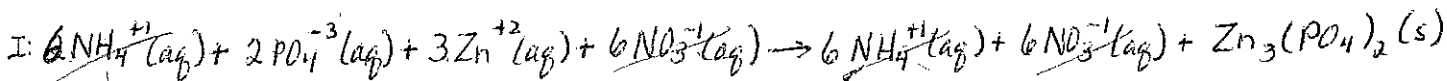
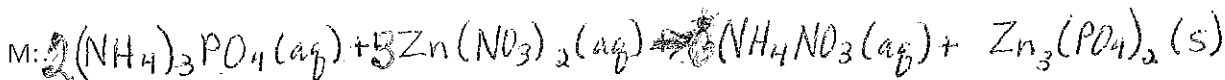
Use the Solubility Table to solve the Net Ionic Equations for the following reactions:



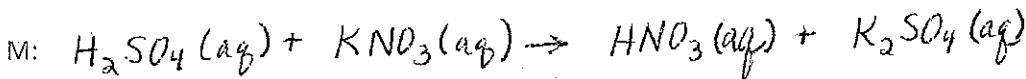
T:

N:

2) Ammonium Phosphate plus Zinc (II) Nitrate \rightarrow



3) Sulfuric Acid is reacted with Potassium Nitrate \rightarrow



I:

NR

N:

Gas Laws

1. How many liters of a gas are in one mole? $22.4L$

2. Write out Boyle's Law, Charles' Law, and Gay-Lussac's Law.

$$\hookrightarrow P_1 V_1 = P_2 V_2 \quad \hookrightarrow \frac{V_1}{T_1} = \frac{V_2}{T_2} \quad \hookrightarrow \frac{P_1}{T_1} = \frac{P_2}{T_2}$$

3. Some students believe that teachers are full of hot air. If Mr. C inhales 2.2 liters of gas at a temperature of $18^\circ C$ and it heats to a temperature of $38^\circ C$ in his lungs, what is the new volume of the gas?

4. What is the combined gas law? $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $\frac{2.2L}{291K} = \frac{x}{311}$ $x = 2.4L$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

5. A gas has a volume of 400.0 mL at $3.00^\circ C$ and 120.0 torr. What would the volume of the gas be at $117.0^\circ C$ and 3350.0 torr of pressure?

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad \frac{(120.0 \text{ torr})(400.0 \text{ mL})}{276K} = \frac{(3350.0 \text{ torr}) V_2}{390K}$$

6. What is Henry's Law?

$$\frac{S_1}{P_1} = \frac{S_2}{P_2}$$

$$18720000 = 991600 V_2$$

7. What is the ideal gas law? $PV = nRT$

$$V_2 = \dots \text{ mL}$$

8. If I have an unknown quantity of gas held at a temperature of 1195 K in a container with a volume of 25 liters and a pressure of 560 atm, how many moles of gas do I have?

$$PV = nRT \quad (560 \text{ atm})(25L) = n(0.08206)(1195K)$$

$$14000 = n(98.0617)$$

$$n = 140 \text{ moles}$$

Acids, Bases and pH

State whether the following are acids or bases.

1. A Have a sour taste.
- * 2. B Has a $[OH^-]$ of 3.6×10^{-5}
3. B Feels slippery
4. B Has a pH of 8.5
5. A+B Is an electrolyte

Properties

* 6. Find the pH of 0.75M HCl.

$$pH = -\log[H^+] \quad pH = .12$$

* 7. Find the molarity of a KOH solution with a pH of 9.5.

$$14 - 9.5 = 4.5 \quad 10^{-pOH} \quad 10^{-4.5}$$

* 8. Is the solution in #6 acidic or basic?

Acidic

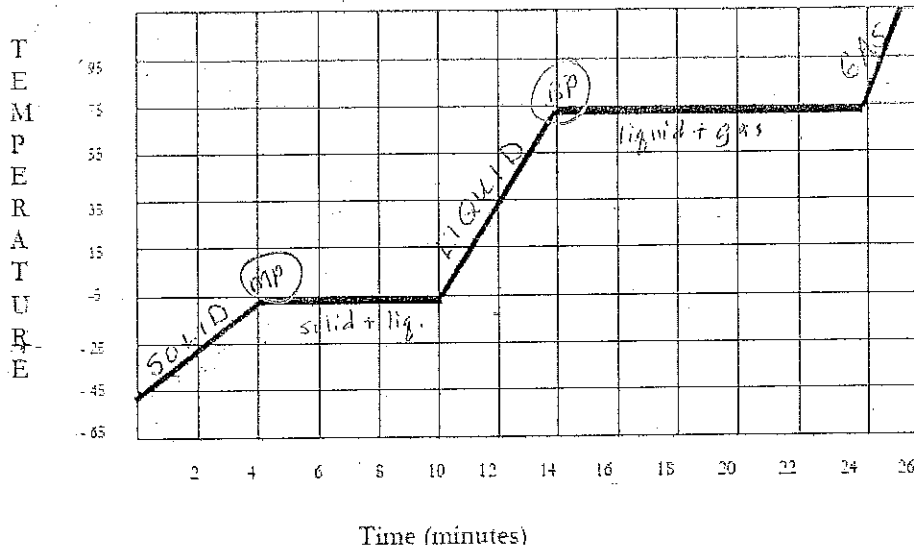
* 9. A solution has a pOH of 3.46. What is the $[H^+]$ and the pH of the solution?

$$14 - 3.46 = 10.54 \text{ pH}$$

Solutions

Heating Curve Solution X

° Celcius



Indicate whether the heating curve would be *flat* or *rising*.

1. Liquid is boiling. > flat
2. Solid is warm. > rising
3. Solid is melting. > flat
4. PE is increasing. > flat
5. KE is increasing. > rising

6. How many grams of $AlCl_3$ are required to make a 2.25M solution in 30.0 g of water?

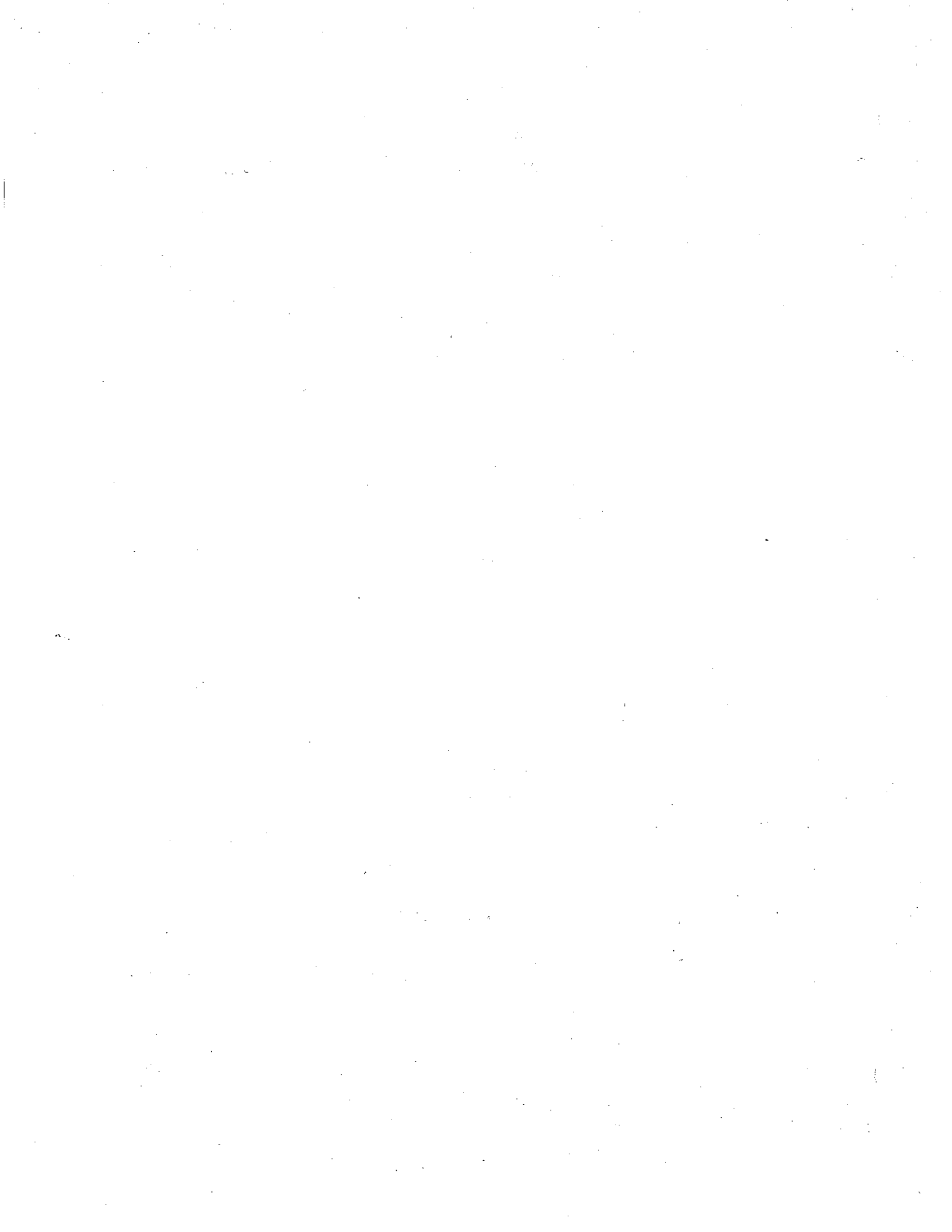
$$M = \frac{\text{mol}}{L} \quad 2.25M = \frac{\text{mol}}{\frac{30.0 \text{ g}}{1.0 \text{ g/mL}}} \quad \frac{0.0675 \text{ mol } AlCl_3}{1 \text{ mol } AlCl_3} \cdot \frac{133.33 \text{ g } AlCl_3}{1 \text{ mol } AlCl_3} = 9.00 \text{ g } AlCl_3$$

7. What volume of 12M HCl is needed to prepare 250 mL of 0.20M HCl?

$$m_1 V_1 = m_2 V_2 \quad \text{Dilution}$$

$$(12M) V_1 = (0.20M) (250 \text{ mL})$$

$$V_1 = 4.2 \text{ mL}$$



Average Atomic Mass

avg. of mass of all isotopes
of an element

1. What is the difference between average atomic mass and mass #? $\rightarrow \#P + \#N$
2. What is the avg. atomic mass for the following:
 - a. C-14 at 1.36%
 - b. C-13 at 2.62%
 - c. C-12 at 96.02%

$$C = 14 \times .0136 = 0.1904$$

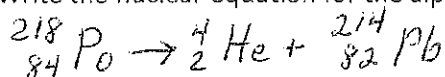
$$C = 13 \times .0262 = 0.3406$$

$$C = 12 \times .9602 = 11.5224 +$$

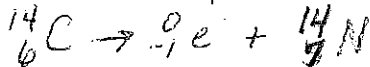
$$12.05 \text{ g/mol}$$

Nuclear Chemistry

1. What causes radioactivity?
when the ratio of protons to neutrons ~~is~~ ^{creates an} unstable nucleus
2. What are the 3 types of radiation? What is the charge of each type?
alpha +2
beta -1
gamma 0
3. What changes during Beta radiation? the atomic # of the element
4. What does a radioactive elements half-life refer to?
the amount of time for the isotope to reduce itself in half (through radiation)
5. What is the main difference between fission and fusion?
splits atoms \rightarrow combines atoms
6. Where is fission utilized?
nuclear power plants
7. Where is fusion utilized?
sun
8. Write the nuclear equation for the alpha decay of polonium-218.

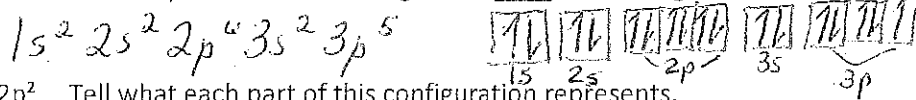


9. Write the nuclear equation for the beta decay of Carbon-14.



Electrons

1. Write the complete electron configuration and orbital diagram for Chlorine.



2. $2p^2$ Tell what each part of this configuration represents.
 $2 = \text{energy level}$ $p = \text{block}$ $\text{exponent} = \# \text{ valence } e^-$
3. How does energy level relate to distance from the nucleus?
larger the E level = furthest from the nucleus
4. Write the Noble gas configuration for Selenium.
 $\text{Se} = [\text{Ar}] 4s^2 3d^{10} 4p^4$
5. Give 2 examples of atoms which will gain 2 electrons to become stable.
O, S, Se, Te
6. Give 2 examples of atoms which will lose 2 electrons to become stable.
Be, Mg, Ca, Sr
7. What element is this? $[\text{Kr}] 5s^2 4d^3$
Niobium
8. How many electrons can occupy each orbital?

$$s = 2 \quad d = 10$$

$$p = 6 \quad f = 14$$

Periodicity

Development of the Modern Periodic Table

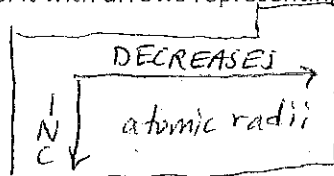
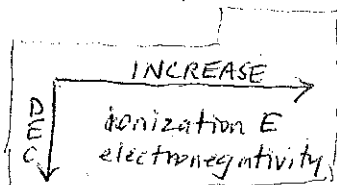
1. Who is the father of the periodic table? How did this scientist arrange his table?
Dmitri Mendeleev by atomic mass
2. What characteristic about his periodic table made it so widely accepted?
the repeating patterns of elements in each column
3. Explain how the periodic table is arranged in groups, families, and periods.
columns, columns rows
4. What are the 3 families of metals?
alkali, alkali earth, transition metals
5. What are the last 2 families of nonmetals? Explain how reactive each family is and why.
halogens - highly reactive because of 7 valence e^- ; close to an octet
noble gases - no reactivity because of 8 " " ; full octet
6. Which elements have characteristics of both metals and nonmetals? Give 2 examples.
metalloids - B, Si, As, Te, Ge, Sb, At
7. Which group of metals and nonmetals are the most reactive? Explain your answer.
metals \rightarrow alkali earth (group 1) only needs to release one valence - to be stable
nonmetals \rightarrow halogens (see @ #5)

Classification of elements

1. How do periods correspond to valence electrons for representative elements?
moving from left to right the # of valence e^- increases by one.
2. How does an elements group correspond to the number of valence electrons?
metals (same #) non-metals (8 - group #)
3. What are the 4 blocks of elements? Where can they be located on the periodic table?
s - groups 1 + 2 d - transition metals
p - groups 13 - 18 f - inner transition metals
4. Why do atoms in the same group have similar chemical properties?
same # valence e^-
5. Alkali Metals and Alkaline Earth Metals represent which block? s
6. Why does the s block only span 2 groups? #
the elements can only hold 2 e^- in their energy level
7. List 4 properties of metals?
- conduct electricity - ductile
- malleable - luster

Periodic Trends

1. Give the definitions of Atomic Radius, Ionization Energy and Electronegativity.
atomic radius - distance between nucleus + outer energy level of an element
ionization E - amount of E needed to remove a valence electron from an element
electronegativity - ability of an element to remove an e^- from another element
2. Draw an outline of the periodic table and label it with arrows representing the trends for each of the above.



3. Explain Ionic radii.
forms when an element gains or loses an electron (size change)
4. What element on the periodic table has the highest electronegativity?
fluorine

5. What is the shielding effect? *the e⁻'s from energy levels between the nucleus & the valence e⁻'s ; block the pull from the nucleus*
6. How does the shielding effect relate to periodicity?

As energy levels increase, the shielding increases and the electronegativity and ionization E decrease.

7. What is the octet rule? How does it apply to periodicity?

Eight e⁻ are needed in the outer energy level to create a stable atom. As you move from group 1 - group 18 the octet

Bonding begins to fill up.

1. List 3 properties of each type of bond: Metallic, Covalent, and Ionic.

I =	1: metal + non-metal	NM =	1: non-metal + non-metal	M =	1. metals melted together
	2: transfer of e ⁻		2: sharing e ⁻		2. electron sharing
	3: high conductivity		3: low conductivity		3. medium conductivity

2. List the 3 types of intermolecular forces from strongest to weakest?

hydrogen, dipole-dipole, London dispersion

3. Give an example of a molecule for each of the above.



4. What is polarity? How does it create surface tension in water?

↳ an uneven sharing of e⁻ ↳ weak areas bond to stronger areas to create H bonds (cohesion)

5. What is a hydrogen bond?

↳ a bond between H and a halogen or a highly electronegative atom

VSEPR (molecular shape)

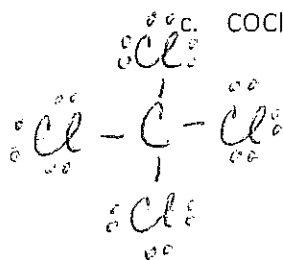
6. What does VSEPR stand for? *valence shell electron pair repulsion*

7. Draw Lewis structures to determine molecular shape, polarity of the molecule and polarity of the bond.

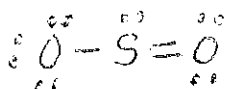
a. CCl₄

b. Sulfur Dioxide

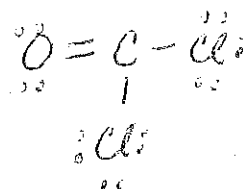
c. COCl₂



*tetrahedral
non-polar molecule
5 = polar bonds*



*bent
polar molecule
very polar bonds
1.0*



*trigonal planar
polar molecule
polar and very polar bonds*

8. What two things are considered areas of high electron density in VSEPR?

lone pairs of electrons and double or triple bonds

9. What takes up more space a lone pair or a bond? Explain how we know? (think bond angles)

A lone pair takes up more space due to the repulsion between the neighboring electrons. The e⁻ push ~~away~~ ^{the} other bonds closer together.

